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ABSTRACT

After reviewing criticisms of the exclusive use of readability formulas to evaluate text difficulty and describing successful efforts to broaden the traditional readability formula approach, this report presents a 20 item checklist for determining text comprehensibility based on four criteria: (1) specific objectives or outcomes expected from the reading material, (2) text organization, (3) language difficulty, and (4) text design, including layout, color, type of print, and use of headings and graphic illustrations. The report then explains how to use the checklist to determine a text's difficulty and concludes that the checklist helps to overcome the conceptual limitations of readability formulas. (MM)

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ASSESSING THE COMPREHENSIBILITY OF TRADE MATERIALS

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Background

Since the 1940's, a vast amount of research has been conducted in the area of "readability", which Gilliland (1972) defined as the "combined effect of all the elements involved in print materials that cause difficulty to the reader" (p.7).

Works by Chall (1958) and Klare (1963) summarized early research into readability and pointed to the need for greater expertise in the design of research studies, understanding of linguistic variables involved, and analysis of results in future research.

Coleman (1968) outlined a number of experiments which had studied grammatical relations and readability. He stated that in most cases when a sentence is rewritten to make it more readable, it

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usually undergoes a grammatical transformation in some form. Coleman concluded his article by suggesting that further research into the improved readability of instructional materials could lead to a greater awareness of the value of transformational grammar.

Bormuth (1968) pointed out that recent research into the readability of written instructional materials had attempted to explain correlations between language and reading difficulty through a more detailed examination of the psychological processes involved.

Several studies into the inherent difficulties of various grammatical measures and their contribution to readability have resulted in either sentence length or word difficulty being cited as the most important variables. MacGinitie and Tretiak (1969) used Yngve's phrase structure measurement and Allen's "sector analysis" on eighty selected passages and compared the results to the Lorge Readability formula applied to tests based on the same passages. Sentence length emerged as the variable most closely correlated with test scores.

In a well designed series of studies, Bormuth (1969) illustrated just how far research into readability was from achieving its objective. He stated, "It had been anticipated that these analyses would simplify the problem of constructing the theory of the comprehension of language. The failure to realize this expectation was spectacular". A main objective of Bormuth's studies was to isolate linguistic features of printed passages and determine which features stood in causal relation to comprehension difficulties.

A total of 94 of the 169 variables used by Bormuth correlated significantly with measures of passage difficulty including eight

out of eight vocabulary variables, 19 out of 50 syntactic structure variables, 34 out of 38 syntactic complexity variables, 25 out of 62 parts of speech variables, and eight out of eleven anaphoric variables. However, it is interesting to note that all eight vocabulary variables and eleven out of twelve of the syntactic length variables included in syntactic complexity, correlated significantly with passage difficulty.

In order to facilitate valid research into the readability of printed materials, Bormuth advocated the use of very large samples of words to enable rarely occurring linguistic variables to be adequately examined. Results obtained from such studies would offer valuable guidance to researchers concerned with the construction of print materials suitable for people at varying levels of reading ability.

In an experiment to investigate the learnability (new learning from a passage) as well as the readability of text books, Guthrie (1970) used eighteen linguistic variables, including sentence length, word difficulty, parts of speech, grammatical transformations, and certain other stimulus dimensions such as word familiarity. Guthrie reported that sentence length and word difficulty were the best predictors of learnability as well as readability.

Recent Readability Formulas

Early attempts to measure the readability levels of materials resulted in instruments which required considerable time and effort to apply. To overcome these problems, Fry in 1968 (revised in 1977) developed a readability formula which used sentence length and

syllables as the two language variables. Fry's formula was relatively easy to apply and correlated highly with a number of existing readabilty formulas.

In 1969 an even more simplistic and purportedly more valid readability formula entitled, "SMOG Grading", had appeared. McLaughlin (1969), the creator of "SMOG", explained that after considerable research into the problem he had concluded that polysyllabic words and sentence length were the most predictive linguistic variables to use in determining the reading difficulty of materials. McLaughlin explained his decison by pointing out that some three years earlier he had shown that words and sentences were, respectively, the best measures of semantic and syntactic characteristics of reading difficulty.

Caylor and Sticht (1973) developed the FORCAST readability formula which was validated on technical job reading materials. They concentrated on the number of monosyllabic words in a 150 word passage. The formula was one of the earliest attempts to specifically analyse the readability of training materials and was not intended for use with primary and secondary school materials or with newspapers and magazines.

Formulas such as these, plus the use of the cloze technique (Taylor, 1953) have been the most widely used readability measures in recent years.

The Problem

Currently there is controversy over the sole use of readability formulas to evaluate the difficulty level of reading materials. Holland (1981) pointed out the limitations of readability formulas

and described the critical language features that eluded formulas.

Her paper was important for it took the criticism of readability a stage further and opened up the more productive area of "comprehensibility" which explored 'valid alternatives to the formulas whose weaknesses have been well demonstrated' (p.3). In particular, Holland emphasised linguistic aspects of words and sentences other than frequency and length, such as the concreteness of words, the syntax of sentences and a number of semantic variables within words and sentences. In addition, she discussed a series of contextual factors that influenced comprehension including the organizational pattern of sentences; aspects of content involving the reader's background knowledge and availability of appropriate 'schemas'; the functions of text materials and the reader's goals; the use of graphics and different forms of visual literacy and other relevant characteristics of the readers such as 'culture-based expectations and abilities' (p.14).

A number of other criticisms against the indiscriminate use of readability formulas were compiled in a report by Lange (1982). The arguments against the use of formulas included the following:

1. The formulas measured <u>readabiiity</u> NOT comprehensibility (Davidson, Lutz and Roalef, 1981).
2. The formulas were not accurate predictors of readability (Kirkwood and Wolfe, 1980).
3. The formulas did not reflect current reading theory, they ignored cultural differences and were not statistically valid (Bruce, Rubin and Starr, 1981).
4. Interests, prior knowledge and incentives were important variables not accounted for (Klare and Schumacher, 1981).

5. Factors such as assumed knowledge, definition of the discourse topic, logical ordering of ideas and syntactic structure should also be used in assessment (Davidson and Kantor, 1982).

The work of Davidson and Kantor (1982) warned of the danger of trying to modify a text to fit a readability level. They used passages from the SRA Reading Laboratory IIIB and showed that in many instances the use of traditional readability techniques (features of vocabulary and sentence length) actually increased the difficulty of the material. Their research concentrated on changes which occurred to clause connections, topic and focus, inference, and point of view and modality during the adaptations. Davidson and Kantor stressed that there was a need for further research into a number of additional factors which affected readability and concluded their research by urging that adaptors should act as 'conscientious' writers rather than someone trying to make a text fit a level of readability defined by a formula (p.187).

Other researchers have offered an evaluation checklist for determining the suitability of content area textbooks (Armbruster and Anderson, 1981); identified reader characteristics, time and purpose factors (Cresmore, 1981); and developed the idea of 'conceptual readability' involving 'three approaches that are sensitive to structural, semantic, and discourse characteristics which encourage children to concentrate on the conceptual level of text in their early reading and writing experiences' (Rubin, 1981).

In general, recent researchers into readability have urged writers not to use formulas as the sole evaluation of texts, have argued against the adapting of materials to 'fit' a specific reading level, and have called for further research into a number of other

variables which may cause difficulty to the reader.

Recent Research

During 1980 the concept of comprehensibility was explored by several researchers in Australia. Edwards (1980) conducted a workshop for the Department of Social Security to investigate ways of improving the readability of various departmental messages.

The results of the workshop confirmed the expectations of the participants that difficult print materials could be rewritten at a more readable level by the use of techniques which extended and broadened the traditional readability formula approach.

The main focus was on the various advice notices and form letters used by the Department. Words or phrases which were considered difficult, ambiguous, figurative (non-literal), in unusual combinations, or of specific terminology, were replaced, where possible, with words which were more readily understood.

As a result it was possible to change basically difficult words such as required, interview, deducted, dissatisfied and entitlement to needed, talk, taken, unhappy, and payment respectively.

Unusual combinations such as In connection with the payment became In order to be paid, and requested to complete was rewritten as please fill in.

With these changes, a form letter which stated:

> 'In connection with the payment of student family allowance for the abovenamed child, you are requested to complete the attached form SC.
> The completed claim should be returned to this office as soon as possible.'

became:

Re: Student Family Allowance

'In order to be paid for your child _____, please fill in form SC and return it to this office as soon as you can'.

Similarly with sentences, the more difficult constructions such as embedding (where an additional piece of information is placed in the middle of a main thought) and inversion (where the main thought is placed at the end of the sentence) were rewritten to make them easier to understand.

An example of an embedded sentence:

'This limit increases by $6.00 for every child, after the first, you have in your care',

became:

'After the first child, this limit increases by $6.00 for every other child you have in your care'.

Sofo (1980) investigated reading materials and practices in Woodwork classes in sixteen Technical Schools in Victoria. Several attempts had been made by schools and by the Woodwork Standing Committee to make instructional materials more attractive and comprehensible to the students. These attempts involving the use of written assignment sheets, vocabulary exercises and crossword exercises failed because they were uninteresting, unattractive and "turned the kids off".

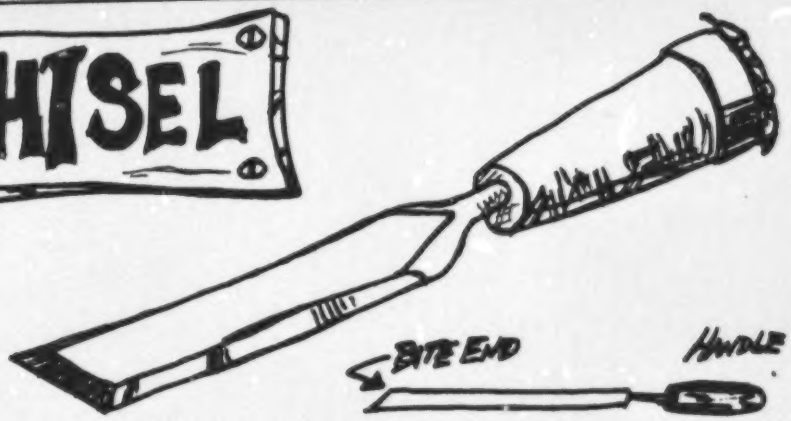
Innovative instructional materials which included attractive simple illustrations, cartoon type figures with humour, relevant to the content and the purpose, proved to be far more successful. An example of this "Innovative Woodwork Material" presented here

clearly illustrates the effective use of the following aspects of comprehensibility:

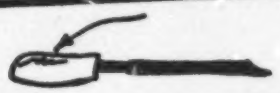
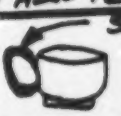
1. It related to the general and specific objectives of the woodwork syllabus.
2. It assisted students in learning to use workshop equipment to efficiently develop practical skills.
3. It explored the use of clear headings, key words and definitions and short, easy sentences.
4. It utilized simple line drawings, graphics and the use of cartoon type characters.
5. It set the scenario as if the reader were performing the tasks.
6. It adopted a consistent and logical layout with maximum white space.

The application of the traditional readability formula was not applicable in this case but it was clearly evident that the above listed aspects of comprehensibility enhanced the appeal and learnability of the material as can be seen in the following example.

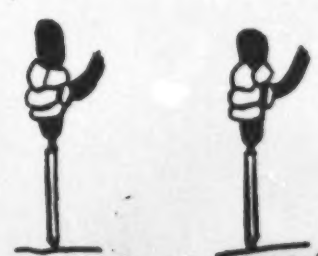
CHISEL



NEW WORDS

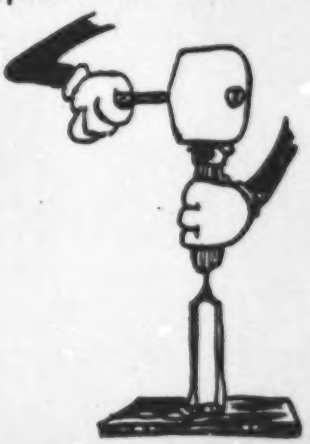
	IN A CHISEL MEANS:	CAN ALSO MEAN:
Handle		
Edge		
Ferrule		
Bevel		

IF YOU ARE USING A CHISEL, WHICH WAY DOES THE BITE END GO?



THIS WAY? -or- THIS WAY?

THIS IS THE BEST WAY TO HOLD A MALLET AND CHISEL.



The Instrument

The comprehensibility strategy presented in this paper uses a checklist involving four major criteria which have a vital bearing on an individual's understanding of learning materials. The criteria are as follows: Objectives, Organization, Language and Design.

Each criterion has a number of characteristics which are listed, making a total of twenty items presented as a "Comprehensibility Checklist".

There are a number of points to consider before using the checklist. The students should have a clear understanding of the instructional objectives, and modifications may have to be made to the language used for some students from different cultural backgrounds. Other factors such as level of ability, prior knowledge and degree of motivation should also be considered by educators wherever possible.

A brief explanation of the comprehensibility criteria follows:

Objectives: It is important to have goals or objectives written in behavioral or performance terms. The behavioral objective is a statement of what is expected of the student at the completion of a task.

The general objective and specific objectives refer to the scope and nature of the expected outcomes.

Organization: This category involves the way the material is structured. Considerations such as providing an overview, stating

the purpose of the material and writing clear, topic sentences assist the reader's comprehension. In addition, the use of a logical sequence of ideas arranged in short paragraphs allows the reader to make the necessary relationships and organize the relevant information.

Language: The use of readability techniques that examine word and sentence characteristics can be augmented with other factors such as the number of times key words are repeated and whether definitions of difficult terms are provided. The readability assessment thus provides an indication of difficulty which can then be adjusted by considering the effects of the other language and comprehensibility variables on the checklist.

Design: The aspects of visual communication such as layout, color, type of print, use of headings and graphic illustrations all make a contribution to the success a reader has in understanding instructional materials.

COMPREHENSIBILITY CHECKLIST (Edwards & Sofo)

Type of Material (video, etc.): _____

Title: _____

Author(s): _____ City: _____

Publisher: _____ Year: _____

Readability Level (if applicable): _____

Readability Technique Used: _____

COMPREHENSIBILITY FACTOR	PRESENT Yes	Partly	No	COMMENTS
OBJECTIVES				
Is the general objective stated?				
Are the specific objectives stated?				
Are the objectives stated in behavioral/performance terms?				
ORGANIZATION				
Is there a topic overview?				
Are there clear topic sentences?				
Are short paragraphs used?				
Is there a logical sequencing of main ideas?				
Is there a low concept load?				
Is there a topic summary?				
LANGUAGE				
Is the vocabulary easy?				
Are common technical terms used?				
Are key words/terms repeated?				
Are definitions of terms provided?				
Are simple sentences used?				
DESIGN				
Is the presentation/layout clear and distinct?				
Is allowance made for interaction?				
Is there an effective use of headings?				
Is there an effective use of print?				
Is there an effective use of graphics?				
Is there an effective use of color?				

NAME: _____ DATE: _____

The Purpose

The purpose of the checklist is to enable a quick analysis to be made of the comprehensibility of instructional material. The procedure is to place a alongside any of the items under the appropriate heading of either "Yes" (present) "Partly" (present), or "No" (not present). An additional column for "Comments" is available for explanatory notes if required.

The checklist can also be used by writers/designers of instructional material in the preparation of learning packages.

When completed, the checklist presents an indication of the number of factors which may make a contribution to a reader's understanding of the material. These factors are in addition to the readability measure of word length (syllables) and sentence length.

A large number of factors present in the material being examined would suggest that the difficulty level of the material would be less likely to be increased, while a small number of factors present would have the opposite effect.

E.g. A selection of trade materials on "Workshop Safety" produced the following results when analysed by the "Comprehensibility Checklist".

Factors Present

Yes	Partly	No
8	5	7

When the "Workshop Safety" material was reorganized along the lines suggested by the "Comprehensibility Checklist", the following results occurred.

Factors Present

Yes	Partly	No
17	2	1

After the alterations it became clear that the only major comprehensibility factor lacking was "color", while most of the other variables listed in the four categories of Objectives, Organization, Language and Design had now been included. Further, the Year 9 readability level (Fry graph) assessed in the original material was reduced to a Year 6 level in the modified version. It would therefore appear after considering all of the comprehensibility factors in the checklist that the difficulty level of the material was substantially reduced.

Conclusion

Reading is not only a matter of skills. A literate person is one who in fact, reads and wants to read, otherwise there is no advantage in possessing the ability to read. The difficulty level of reading material, therefore, can seriously affect an individual's motivation to read.

The Edwards and Sofo checklist is designed to assess the comprehensibility of instructional materials. The checklist augments the use of readability formulas and offers a strategy to overcome the conceptual limitations of the formulas pointed out by research.

The inclusion of factors such as Objectives, Organization, Language and Design allows the use of professional judgment to be made on a host of important variables not considered by readability formulas alone. In addition, characteristics of the audience are considered in conjunction with the comprehensibility assessment.

Research is continuing with the checklist to improve its useability but in its present form it is offered as a starting point for further investigation into the development of more effective measuring instruments in the area of comprehensibility.

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